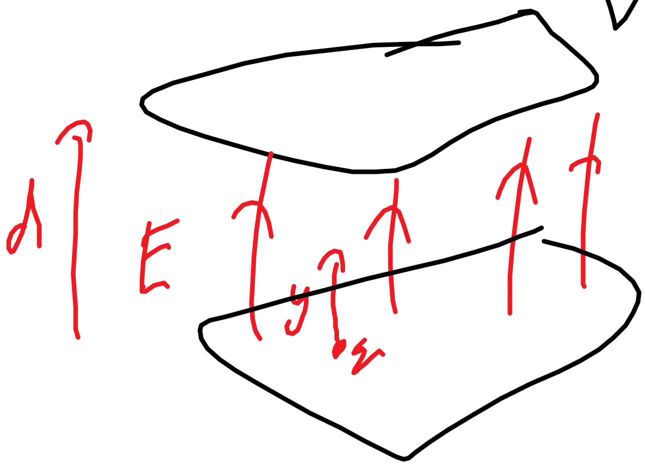


$V_1 = -250V$

ΔV

$V_2 = 250V$

$\Delta V = V_2 - V_1$

$V_2 > V_1$

$E = \frac{F}{q} = \frac{\Delta V}{d} = \frac{500V}{d}$

$W = Fy = Eqy = \frac{500V}{d} q y$

1. A 6.0 micro coulomb charge is 20.0 cm from a -3.5 micro coulomb charge.

a) What is the force between the charges?

$F_e = \frac{kQq}{r^2} = \frac{9\times10^9 \frac{Nm^2}{C^2} (3.5)(6)10^{-12}}{(0.2m)^2}$

$= 4.7$ ~~x10~~ N Attractive

b) What is the electrostatic energy of the -3.5μC charge relative to zero at

infinity?

$$E_e = -\frac{kQq}{r} = \boxed{-0.94\ J}$$

c) What is the field strength at the midpoint between the charges?

(+) · (−)

$$E = E_1 \oplus E_2$$

vector Addition

$$E = \frac{kQ_1}{r_1^2} + \frac{kQ_2}{r_2^2} = \frac{9\times10^9}{(0.1)^2}\left(6\times10^{-6} + 3.5\times10^{-6}\right)$$

$$= \boxed{8.55\times10^6\ \frac{N}{C}}\quad \boxed{\text{from + to −}}$$

Mag direction

d) What is the potential at the midpoint between the charges

Not a vector so

V1 + V2 = (kQ1)/r + (kQ2)/r = k/r (Q1+Q2)

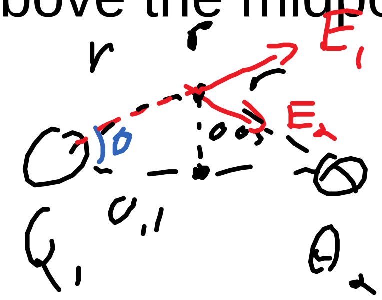
$9x10^9(-3.5x10^{-6}+6x10^{-6})/0.1m = Nm^2/C^2$ C/m

Nm/C

2.25×10^4 J/C = 2.25×10^4V

e) What is the field strength and potential 5.0

cm above the midpoint?



$r = \sqrt{0.1^2 + 0.05^2}$

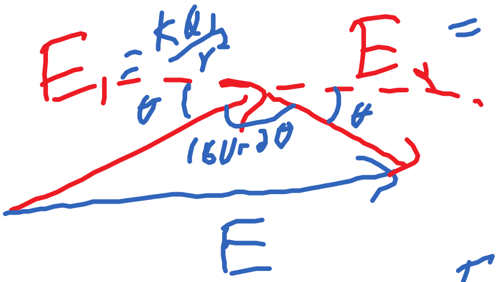
$= 0.1118\ m$

V1 + V2 = (kQ1)/r + (kQ2)/r

$9x10^{9}(-3.5x10^{-6}+6x10^{-6})/0.1118m$

$2.0\ x\ 10^{4}$ J/C = $2.0\ x\ 10^{4}$V

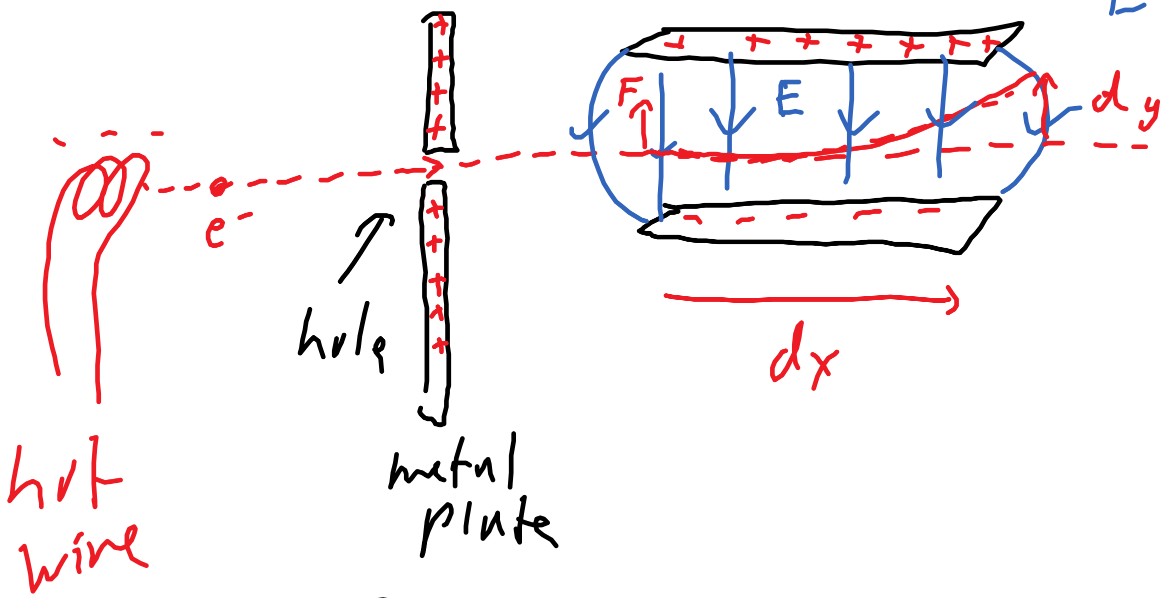
$\theta = \tan^{-1}\frac{0.05}{1}$



Cosine law

$E^2 = E_1^2 + E_2^2 - 2E_1E_2\cos\phi$

$E = \frac{V}{d}$



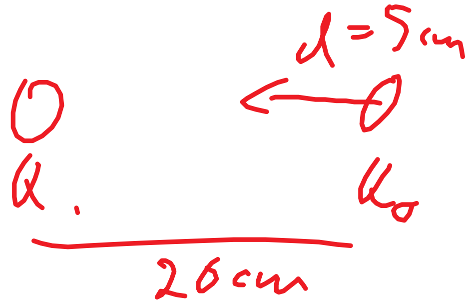
+700V =

f) How much work is done moving the -3.5μC

charge 5.0 cm closer?

Don't use Fd !!!!!!!

not constant

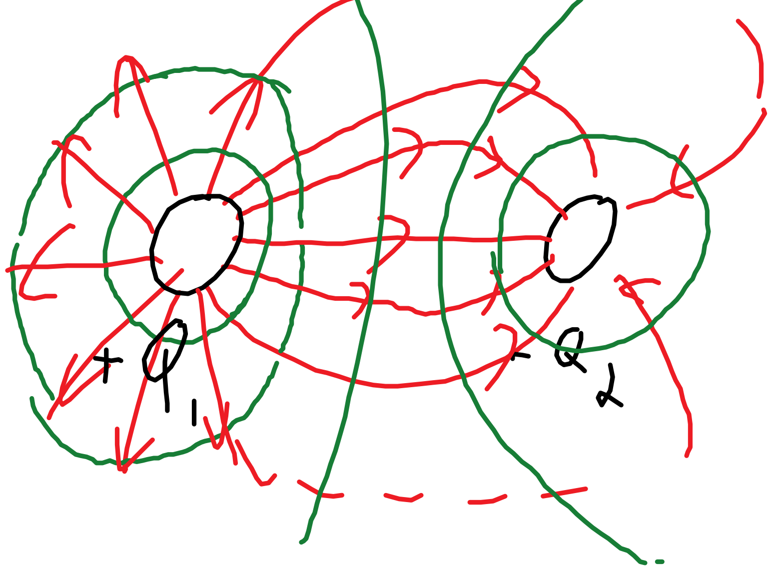


$W = E_{ef} - E_{ei} = kqQ(1/rf - 1/ri)$

$9\times10^{9}(-3.5\times10^{-6})(6\times10^{-6})(1/0.15 - 1/0.2)$

-0.315 J

g) Draw field lines and equipotential lines.



2. A cathode ray tube has an accelerating voltage of 700V before going between two parallel plates, 0.50 cm apart, 4.0 cm long and 20.0V of potential between them.

a) What is the speed of an electron after being accelerated by 700V?

V=change in energy/q

Ek = Vq = 700 eV of energy

Ek = 700 J/C (1.602×10^{-19}C) = 1/2 mv^2

v= root ($2 \times 700 \times 1.602\times10^{-19}/9.11\times10^{-31}$)

v= 1.6×10^{7} m/s

b) What is the field strength between the parallel plates?

$E=V/d = 20V/0.005m = 4\ 000\ N/C$

c) What is the acceleration of the electron between the plates?

$a=F/m = Eq/m =$
$4000N/C x 1.6x10^{-19}C/9.11x10^{-31}kg$
$a= 7.0 \times 10^{14}\ m/s^2$

a) What is the total deflection of the beam as it passes through the plates?

$s_x = v_x t$
$0.040m = 1.6 \times 10^7 m/s\ t$
$t= 2.5 \times 10^{-9}s$

$s_y = 1/2\ at^2 = 1/2\ 7.0 \times 10^{14}\ m/s^2 (2.5 \times 10^{-9}s)^2 = 0.22\ cm$